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Studying Materials in Extreme Conditions by Using Single-Shot Ptychography and Talbot Interferometry Methods[1] DANIEL HODGE, Brigham Young University, ARIANNA GLEASON, Stanford Linear Accelerator Center, RICHARD SANDBERG, Brigham Young University — In this talk, we will present how we are developing a method to study materials under extreme conditions with the combination of Talbot interferometry and single-shot ptychography with x-ray free electron lasers. In general, ptychography is a computational method of microscopic imaging. This is an experimental technique that involves recording and processing an extensive amount of diffraction patterns from an object that is displaced to various positions relative to an illuminating beam. Allowing for quicker acquisition time, we plan to use single-shot ptychography, where several partially overlapping laser beams will illuminate an object simultaneously. Similar to ptychography, for single-shot ptychography, we will use sophisticated phase retrieval algorithms to reconstruct the phase and amplitude of the object based on the information in the diffraction data we obtain. Since we will be working with ultrafast x-ray beams, we will use the Talbot wavefront sensor to monitor the x-ray beam incident on the object, thus ensuring that the beam is operating as expected. Characterization of the beam, together with the knowledge of how materials behave under extreme conditions, will enable us to create better materials for fusion energy.

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